



US011367075B2

(12) **United States Patent**
Lu et al.

(10) **Patent No.:** **US 11,367,075 B2**
(45) **Date of Patent:** **Jun. 21, 2022**

(54) **METHOD, APPARATUS AND ELECTRONIC DEVICE FOR IDENTIFYING RISKS PERTAINING TO TRANSACTIONS TO BE PROCESSED**

(58) **Field of Classification Search**
CPC G06Q 20/4016; G06Q 10/0635; G06Q 20/4014; G06Q 20/40; G06Q 10/06; G06N 20/00; H04L 63/1433; H04L 63/20
See application file for complete search history.

(71) Applicant: **Advanced New Technologies Co., Ltd.**, Grand Cayman (KY)

(56) **References Cited**

(72) Inventors: **Yicheng Lu**, Zhejiang (CN); **Tao Chen**, Zhejiang (CN); **Wenbiao Zhao**, Zhejiang (CN)

U.S. PATENT DOCUMENTS

5,819,226 A * 10/1998 Gopinathan G06Q 20/00 705/44
6,714,918 B2 * 3/2004 Hillmer G06Q 20/206 705/18

(73) Assignee: **Advanced New Technologies Co., Ltd.**, Grand Cayman (KY)

(Continued)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

FOREIGN PATENT DOCUMENTS

CN 101504745 A * 8/2009 G06Q 30/00
CN 104202339 A 12/2014

(Continued)

(21) Appl. No.: **16/774,845**

(22) Filed: **Jan. 28, 2020**

OTHER PUBLICATIONS

(65) **Prior Publication Data**
US 2020/0167792 A1 May 28, 2020

Quah, Jon and Sriganesh, M, "Real Time Credit Card Fraud Detection using Computational Intelligence," Proceedings of International Joint Conference of Neural Networks, Aug. 12-17, 2007 (Year: 2007).*

(Continued)

Related U.S. Application Data

(63) Continuation of application No. 16/440,164, filed on Jun. 13, 2019, which is a continuation of application No. PCT/CN2018/091042, filed on Jun. 13, 2018.

Primary Examiner — Kenneth Bartley
(74) *Attorney, Agent, or Firm* — Finnegan, Henderson, Farabow, Garrett & Dunner, LLP

Foreign Application Priority Data

Jun. 15, 2017 (CN) 201710452172.6

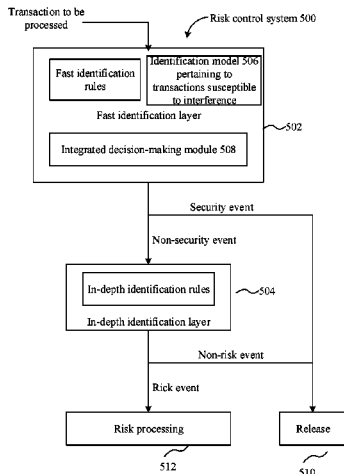
(57) **ABSTRACT**

(51) **Int. Cl.**
G06Q 20/40 (2012.01)
G06N 20/00 (2019.01)
(Continued)

A method for identifying a risk pertaining to a transaction to be processed, includes: identifying a risk pertaining to a transaction to be processed via a fast identification layer in a risk control system, thereby obtaining a first identification result; identifying a risk of interference pertaining to the transaction to be processed via a model for identifying transactions susceptible to interference, thereby obtaining a second identification result; and determining a processing manner for the transaction to be processed based on the first identification result and the second identification result, the

(Continued)

(52) **U.S. Cl.**
CPC **G06Q 20/4016** (2013.01); **G06N 20/00** (2019.01); **G06Q 10/0635** (2013.01);
(Continued)



processing manner including releasing the transaction to be processed, or further identifying the risk pertaining to the transaction to be processed via the in-depth identification layer in the risk control system.

17 Claims, 7 Drawing Sheets

- (51) **Int. Cl.**
G06Q 10/06 (2012.01)
H04L 9/40 (2022.01)
- (52) **U.S. Cl.**
CPC **G06Q 20/4014** (2013.01); **H04L 63/1433**
(2013.01); **H04L 63/20** (2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,490,162	B1 *	7/2013	Popoveniuc	.....	H04L 63/08	
						726/5
8,572,391	B2 *	10/2013	Golan	.....	G06F 21/40	
						705/72
9,047,608	B1	6/2015	Einav			
9,178,858	B1	11/2015	Mussman et al.			
10,062,078	B1 *	8/2018	Boates	.....	G06Q 20/4016	
10,237,294	B1 *	3/2019	Zadeh	.....	H04L 63/1425	
10,290,053	B2 *	5/2019	Priess	.....	G06Q 40/00	
10,460,320	B1 *	10/2019	Cao	.....	G06N 20/00	
10,965,696	B1 *	3/2021	Amram	.....	H04L 63/1425	
2002/0194119	A1 *	12/2002	Wright	.....	G06Q 30/0609	
						705/38
2003/0023543	A1 *	1/2003	Gunewardena	.....	G06Q 40/00	
						705/38
2004/0098588	A1 *	5/2004	Ohba	.....	H04L 63/08	
						713/169
2005/0097320	A1	5/2005	Golan et al.			
2005/0182712	A1	8/2005	Angell			
2005/0234763	A1	10/2005	Pinto et al.			
2006/0130147	A1 *	6/2006	Von-Maszewski	.....	
					H04L 63/1408	
						726/25
2007/0208493	A1 *	9/2007	Downs	.....	G08G 1/0104	
						701/117
2008/0140576	A1 *	6/2008	Lewis	.....	G06Q 40/025	
						705/67
2009/0152343	A1 *	6/2009	Carter	.....	G06Q 10/0633	
						235/379
2010/0094768	A1 *	4/2010	Miltonberger	.....	G06Q 10/067	
						705/325
2011/0082767	A1 *	4/2011	Ryu	.....	G06Q 20/40	
						705/26.35

2013/0024339	A1 *	1/2013	Choudhuri	.....	G06Q 30/0185	
						705/35
2013/0024358	A1 *	1/2013	Choudhuri	.....	G06Q 20/4016	
						705/38
2014/0304158	A1 *	10/2014	Basu	.....	G06Q 20/34	
						705/44
2015/0026027	A1 *	1/2015	Priess	.....	G06Q 40/00	
						705/35
2016/0055427	A1 *	2/2016	Adjoute	.....	G06Q 30/0201	
						706/12
2016/0104163	A1 *	4/2016	Aquino	.....	G06Q 40/12	
						705/44
2018/0248918	A1 *	8/2018	Shen	.....	G06F 21/552	
2018/0374098	A1 *	12/2018	Zhang	.....	G06N 20/00	
2019/0026657	A1 *	1/2019	Zhou	.....	G06F 9/5027	
2019/0130406	A1 *	5/2019	Marcjan	.....	G06N 5/022	
2019/0258927	A1 *	8/2019	Chen	.....	G06N 20/10	
2019/0295088	A1 *	9/2019	Jia	.....	G06Q 20/4016	
2019/0295092	A1 *	9/2019	Lu	.....	G06N 20/00	
2019/0303728	A1 *	10/2019	Zheng	.....	G06N 20/00	
2020/0034426	A1 *	1/2020	Sun	.....	G06F 16/334	

FOREIGN PATENT DOCUMENTS

CN	104392381	A *	3/2015	.....	G06Q 40/04
CN	106503562	A	3/2017		
CN	106557955	A	4/2017		
CN	106656932	A	5/2017		
EP	3543922	A1 *	6/2018	.....	G06Q 10/06
KR	10-2016-0070379		6/2016		
KR	10-2017-0041731		4/2017		
WO	WO 98/54667		12/1998		
WO	WO 2017/076176	A1 *	5/2017	.....	H04L 29/06
WO	WO 2017/076176	A1	5/2017		
WO	WO 2018/228427	A1 *	12/2018	.....	G06Q 10/06

OTHER PUBLICATIONS

Shen et al, WO 2017/076176, EPO English machine translation, May 11, 2017 (Year: 2017).*

Extended European Search Report for European Application No. 18817011.2 from the European Patent Office, dated Jan. 13, 2020.

International Search Report in International Application No. PCT/CN2018/091042, dated Aug. 29, 2018.

Written Opinion for Application No. 11201905799W, issued by the Intellectual Property Office of Singapore, dated May 18, 2020.

Notice of Preliminary Rejection in Korean Application No. 10-2019-7017081, dated Mar. 29, 2021.

Decision to Grant from the Japanese Patent Office for Japanese Patent Application No. 2019-529920, dated Apr. 2, 2021.

Examination Report for European Application No. 18817011.2, dated Jan. 15, 2021.

Written Opinion for Application No. 11201905799W, issued by the Intellectual Property Office of Singapore, dated Feb. 26, 2021.

* cited by examiner

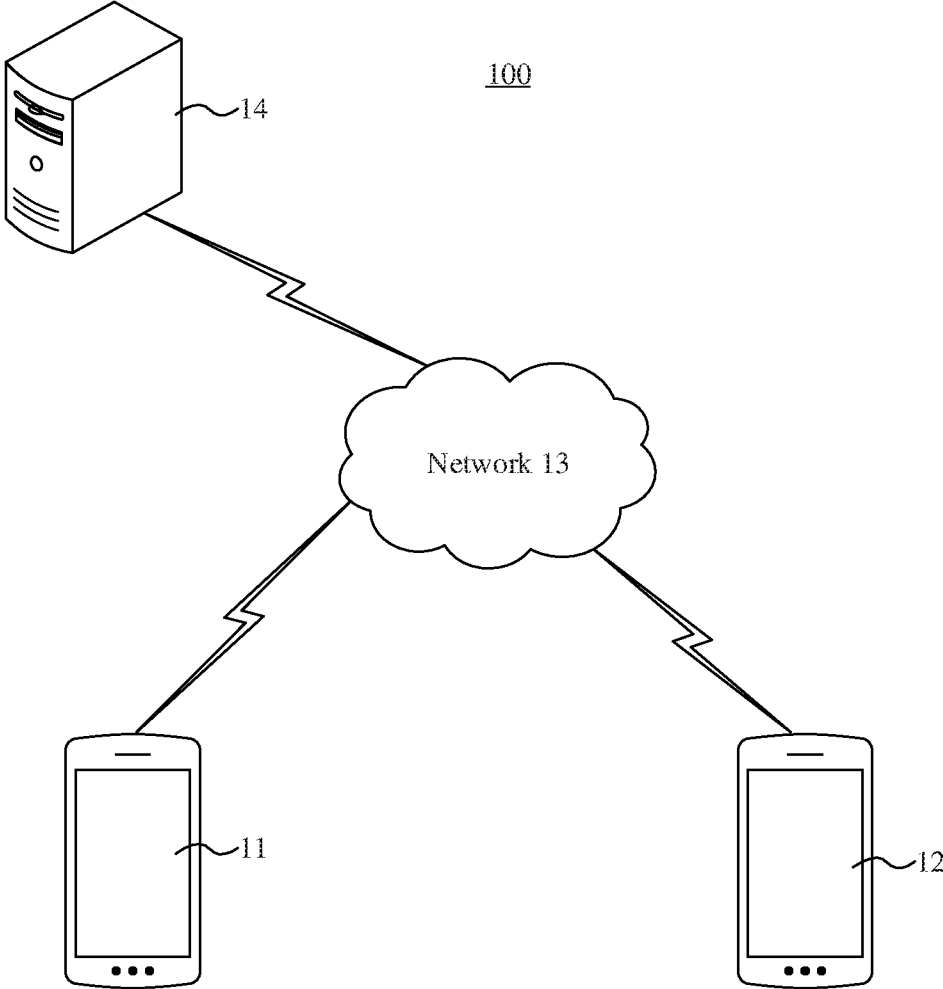


FIG. 1

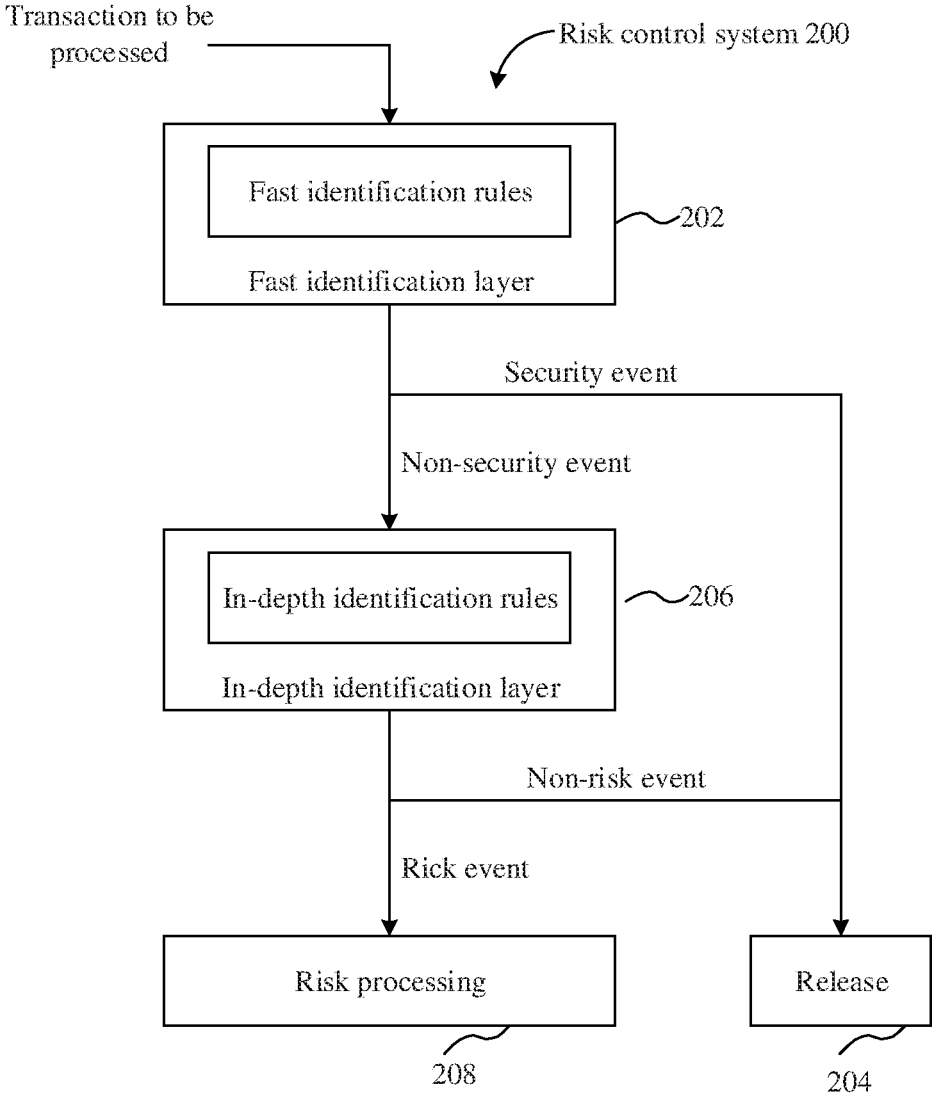


FIG. 2

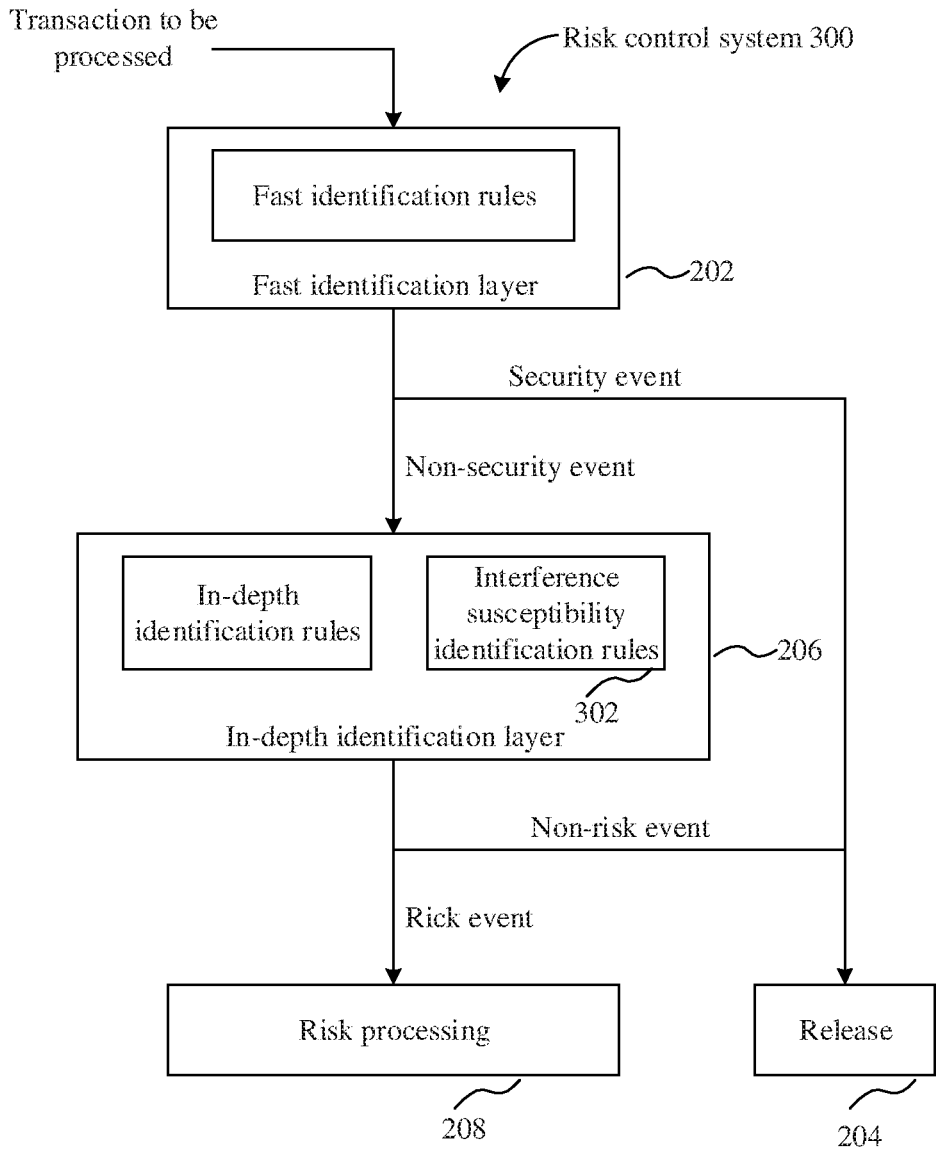


FIG. 3

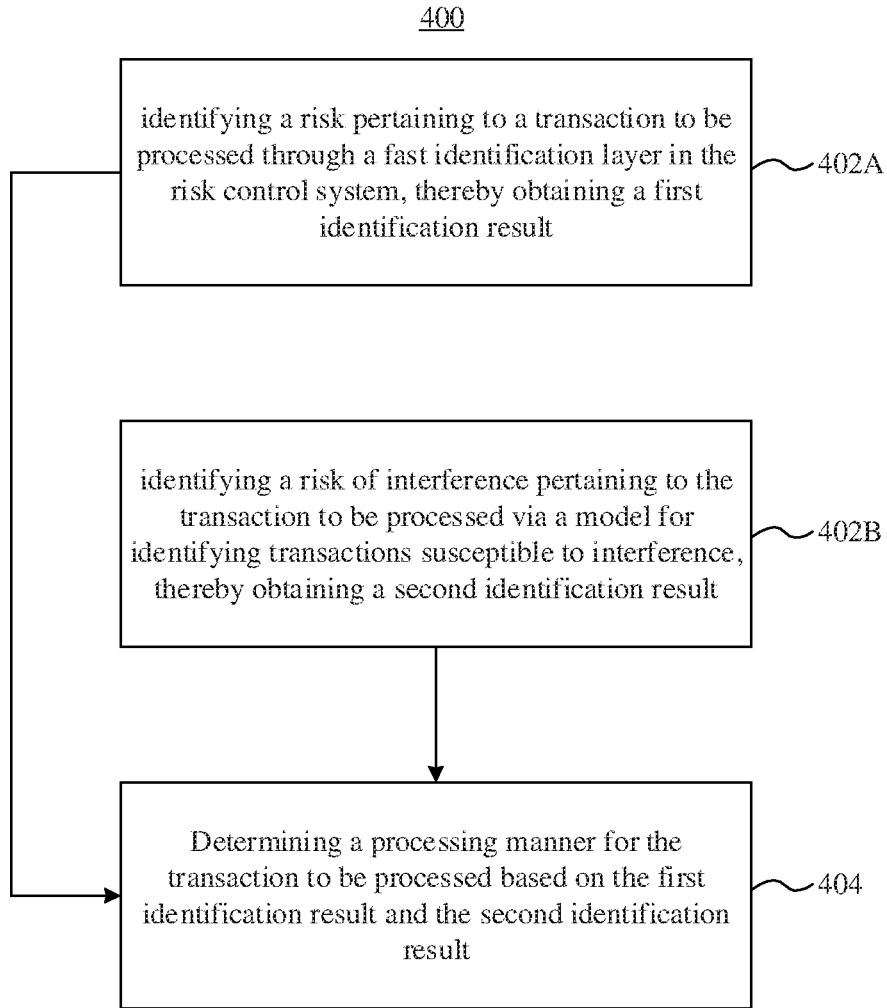


FIG. 4

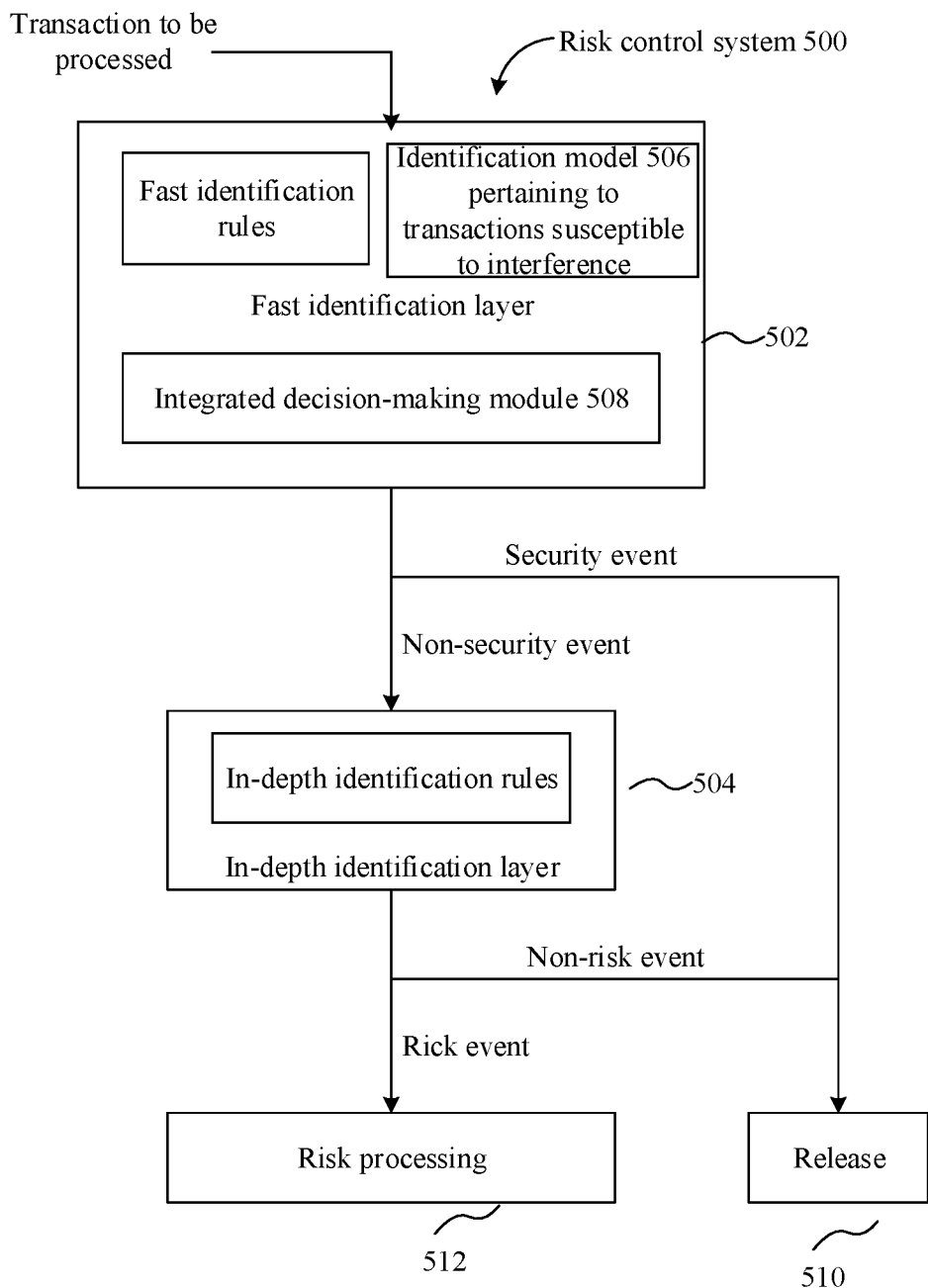


FIG. 5

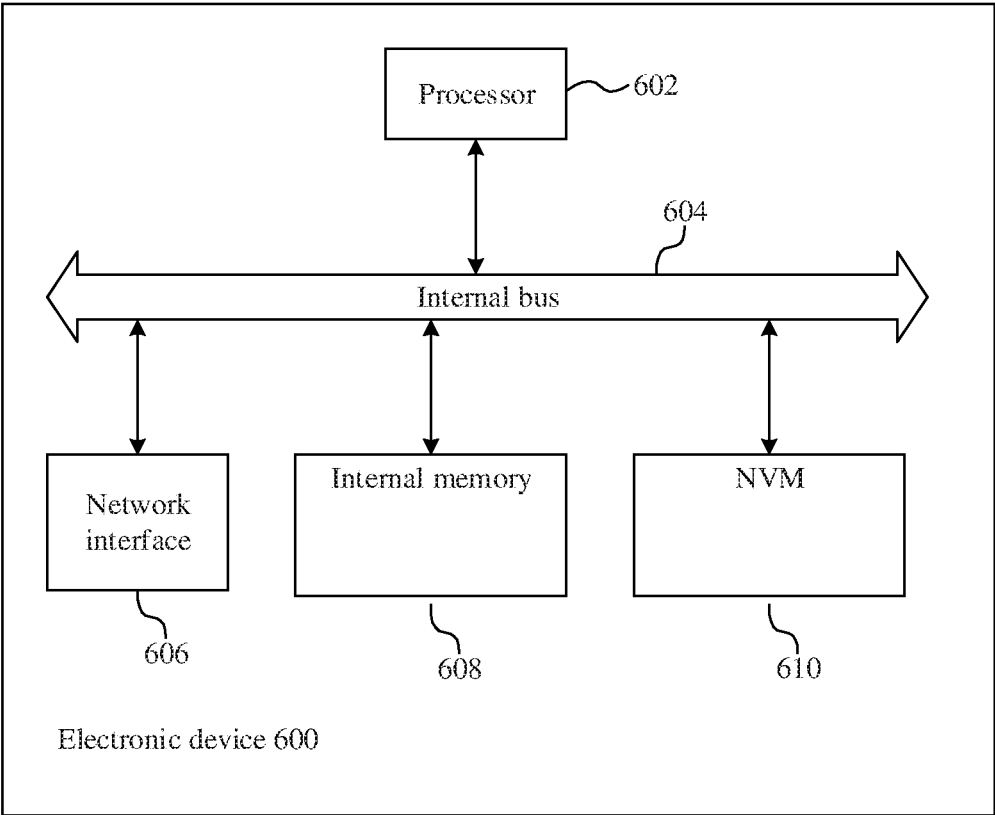


FIG. 6

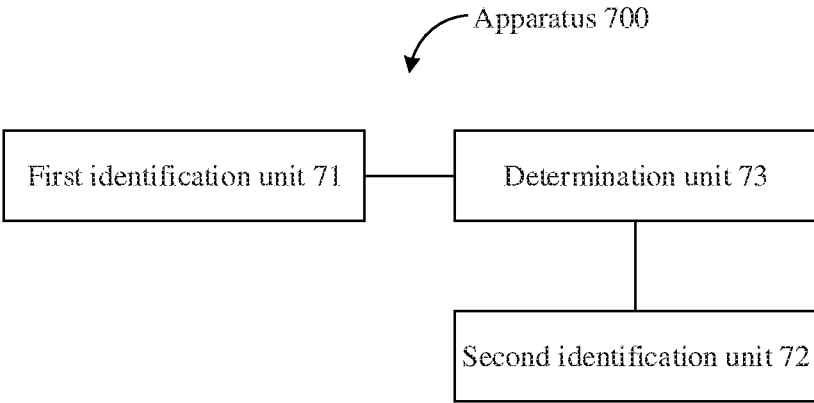


FIG. 7

**METHOD, APPARATUS AND ELECTRONIC
DEVICE FOR IDENTIFYING RISKS
PERTAINING TO TRANSACTIONS TO BE
PROCESSED**

CROSS-REFERENCE TO RELATED
APPLICATIONS

This application is a continuation application of U.S. application Ser. No. 16/440,164, filed on Jun. 13, 2019, which is a continuation application of International Application No. PCT/CN2018/091042, filed on Jun. 13, 2018, which is based upon and claims priority to Chinese Patent Application No. 201710452172.6, filed on Jun. 15, 2017, the entire content of all of which is incorporated herein by reference.

TECHNICAL FIELD

This application involves the technical field of risk control, in particular, a method, apparatus, and electronic device for identifying risks pertaining to transactions to be processed.

TECHNICAL BACKGROUND

Among related technologies, more and more transactions are being processed on online platforms instead of traditional ways. Users only need to register corresponding user accounts on an online platform before he or she is able to complete transactions on the online platform using the registered user account. However, while online platforms bring convenience to transactions, they bring about security issues too. For example, if a user account is leaked, it is subject to the risk of theft and may even cause serious losses.

To address this, a risk control system has been established in the related technologies for transactions that are processed on online platforms to assess the risks of transactions, thereby detecting potential security risks as early as possible and avoiding account theft.

However, the risk control system may over-assess risks pertaining to transactions for some reasons, resulting in false positives of account theft risks even in the case where no account theft risk is existent. As a result, the transaction is required to perform user authentication, the transaction is deemed as not successfully processed, and the use account becomes restricted, thereby “disturbing” the user. The transaction is therefore an interfered transaction. Interfered transactions not only result in additional operations, lengthen the processing time, but may also reduce success rate of the transactions.

SUMMARY

In view of this, this application provides a method, apparatus and electronic device for identifying a risk pertaining to a transaction to be processed, which can lower the improvement requirements needed for a risk control system, and improve the efficiency and accuracy of identification of transactions susceptible to interference.

According to a first aspect, a method for identifying a risk pertaining to a transaction to be processed, comprises: identifying a risk pertaining to transaction to be processed via a fast identification layer in the risk control system, thereby obtaining a first identification result; identifying a risk of interference pertaining to the transaction to be processed via a model for identifying transactions suscep-

tible to interference, thereby obtaining a second identification result; and determining a processing manner for the transaction to be processed based on the first identification result and the second identification result, the processing manner including releasing the transaction to be processed, or further identifying the risk pertaining to the transaction to be processed via an in-depth identification layer in the risk control system.

According to a second aspect, an electronic device comprises: a processor; and a memory storing instructions executable by the processor; wherein the processor is configured to: identify a risk pertaining to a transaction to be processed via a fast identification layer in the risk control system, thereby obtaining a first identification result; identify a risk of interference pertaining to the transaction to be processed via a model for identifying transactions susceptible to interference, thereby obtaining a second identification result; and determine a processing manner for transactions to be processed based on the first identification result and the second identification result, the processing manner including releasing the transaction to be processed, or further identifying the risk pertaining to the transaction to be processed via an in-depth identification layer in the risk control system.

According to a third aspect, a non-transitory computer-readable storage medium has stored therein instructions that, when executed by a processor of a device, cause the device to perform the methods as described in the first aspect.

It can be seen that the technical solution identifies transactions susceptible to interference via a fast identification layer and a model for identifying transactions susceptible to interference before the in-depth identification of the risk control system, thereby identifying transactions susceptible to interference quickly and accurately in the scenario where risks are controllable, and reducing the probability of transactions susceptible to interference being interfered with, as well as reducing the impact on the risk control system and lowering the improvement requirements needed for the risk control system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a risk identification system for transactions to be processed according to an exemplary embodiment.

FIG. 2 is a schematic diagram of a risk control system in the related technologies.

FIG. 3 is a schematic diagram of another risk control system in the related technologies.

FIG. 4 is a flowchart of a risk identification method for transactions to be processed according to an exemplary embodiment.

FIG. 5 is a schematic diagram of a risk control system according to an exemplary embodiment.

FIG. 6 is a schematic diagram of an electronic device according to an exemplary embodiment.

FIG. 7 is a flowchart of a risk identification method for transactions to be processed according to an exemplary embodiment.

DETAILED DESCRIPTION OF EMBODIMENTS

FIG. 1 is a schematic diagram of a risk identification system **100** for transactions to be processed, according to an exemplary embodiment. As shown in FIG. 1, the system **100** may include electronic devices, such as a mobile phone **11** and a mobile phone **12**, a network **13**, and a server **14**.

The mobile phones **11** and **12** are exemplary electronic devices usable by users. Examples of the electronic devices may also include: a tablet, a laptop, a pocket PC or PDA (Personal Digital Assistant), wearable devices (e.g., smart glasses, smart watches), etc., which are not limited here. When running, the electronic device may run a client program of an application to achieve relevant transaction functions of the application. For example, the relevant transaction functions may include the transactions to be processed, e.g. a payment transaction, etc.

The server **14** may include a physical server with dedicated hosting, or truly be a virtual server hosted on a server cluster, or may be a cloud server. When running, the server **14** may load and run a risk control system, thereby achieving risk control functions and identification functions for transactions susceptible to interference.

The network **13** may provide interaction between the mobile phones **11** and **12** and the server **14**, and may include one or more types of wired and wireless networks. In an embodiment, the network **13** may include a Public Switched Telephone Network (PSTN) and Internet. At the same time, electronic devices such as the mobile phones **11** and **12** can also perform communication interaction through the network **13**, for example, establishing and implementing the transactions to be processed between any two electronic devices. The risk control system running on the server **14** can identify an account theft risk of the transactions to be processed to reduce the probability of the account theft risk evolving into an account theft event.

Based on identification principles, the risk control system can accurately identify possible risk issues of the transactions to be processed by using configured identification rules. For example, the identification rules may include manually defined rules or models obtained through machine learning (for example, decision tree-based machine learning or in-depth learning based on neural networks, etc., which are not limited here). Nevertheless, due to the complexity of risk identification, it may be necessary to adopt a large number of identification rules to accurately identify the transactions to be processed. Therefore, the identification process may not only consume a large amount of processing computing resources, but also cause operating users to wait for a long time. In fact, as transactions involving account theft risk generally account for a small portion and most of the transactions are security events, if all transactions undergo the processing of the identification rules, this may lead to the wastage of a large amount of processing computing resources, affect use experience of relevant operating users, and even lower the success rate of transaction processing.

Therefore, as shown in FIG. 2, identification rules of a risk control system **200** are divided into two layers in the related technology: a fast identification layer (also referred to as layer T1) and an in-depth identification layer (also referred to as layer T2). When the risk control system **200** detects the transactions to be processed, layer T1 first identifies the transactions to be processed (**202**); layer T1 is configured with fewer fast identification rules (which may include at least one of the various types of the above-described manually defined rules or machine learning models, etc., which is not limited here), and through these fast identification rules, it can quickly identify the transactions to be processed that are security events (e.g., there is no or almost no risk of account theft). For example, the transactions to be processed may be identified as a security event on layer T1 in most cases and the risk control system **200** may release the transactions to be processed (**204**) so that the

transactions to be processed may continue to be implemented. However, if a transaction to be processed is not identified as a security event, namely, the transaction to be processed is a non-security event in the sense of layer T1 (e.g., the transaction to be processed is not an obvious security event, but there may not necessarily be risk of account theft), then the transaction to be processed can be further transferred to layer T2 for identification (**206**). Layer T2 is configured with more in-depth identification rules (which may include at least one of the various types of the above-described manually defined rules or machine learning models, etc., which is not limited here), and through these in-depth identification rules, it can accurately identify whether the transaction to be processed has a risk of account theft. If layer T2 is identified as a risk-free event, the risk control system **200** releases the transaction to be processed (**204**), and if layer T2 identifies a risk event (e.g., there is risk of account theft), the risk control system **200** performs risk processing on the transaction to be processed (**208**), such as by requiring the operating user to perform identification verification, reporting processing failure, or restricting the authority of the user account corresponding to the operating user. It can be seen that the above-described division of layer T1 and layer T2 can significantly improve the risk identification efficiency of the transactions to be processed.

Based on the description of the Background section, it can be known that interference may be caused to users when a risk control system is identifying the risk of account theft. To this end, a risk identification process may be implemented to reduce the probability of “disturbing” users. FIG. 3 is a schematic diagram of a risk control system **300** in the related technology for performing identification on transactions susceptible to interference, which means there is a higher probability of the occurrence of the following: the risk control system determines that a transaction is subject to risk of account theft, but the transaction does not actually have this risk (for example, it is subsequently determined that this risk does not exist), thereby causing an “interference” to the corresponding user. As shown in FIG. 3, the related technology follows the identification rules originally adopted by the risk control system **200** (FIG. 2), and rules **302** pertaining to transactions susceptible to interference, which focuses on the transactions susceptible to interference, may be added to the in-depth layer, and the identified transactions susceptible to interference may be released to avoid interference.

As the rules **302** pertaining to transactions susceptible to interference may need to be properly matched with the original identification rules, this may make the configuration process of the rules **302** pertaining to transactions difficult and may easily make an impact on the original identification rules, which not only increase the labor costs of the operator and the maintenance cost of the risk control system, but may even affect the accuracy and efficiency of identifying account theft risk. At the same time, transactions susceptible to interference are easy to update, for example, when there are new interference user groups or new interference scenarios, etc. These may require timely adjustments to the above-described identification rules for interference, thereby further increasing the difficulty and cost of maintaining the risk control system.

In order to solve the above problems in the related technology, a risk identification method is provided. At layer T1, a model for identifying transactions susceptible to interference that is independent of layer T2 is adopted, thereby quickly and accurately identifying transactions susceptible to interference in cases where risk is controllable. Moreover, update processing may be implemented for the

model for identifying transactions susceptible to interference, and the maintenance difficulty and maintenance cost of the risk control system can be significantly reduced.

FIG. 4 is a flowchart of a risk identification method 400 for transactions to be processed, according to an exemplary embodiment. As shown in FIG. 4, the method 400 may include the following steps:

In step 402A, the risk of a transaction to be processed is identified by a fast identification layer in a risk control system to obtain a first identification result.

In the embodiment, the first identification result corresponds to the identification result obtained by the risk control system through the fast identification layer of the related technology (FIG. 2). The first identification result can be obtained by the risk control system by applying the fast identification rules to the transaction to be processed.

In step 402B, a second identification result is obtained by identifying an interference risk of the transaction to be processed through the above-described identification model pertaining to transactions susceptible to interference.

In the embodiment, there is no necessary sequence in obtaining the first identification result and the second identification result.

In the embodiment, as the fast identification layer adopts far fewer fast identification rules than the number of in-depth rules adopted by the in-depth identification layer, even if there is a certain degree of influence between the model for identifying transactions susceptible to interference and the fast identification rules, the fast identification rules may be optimized based on the lower cost and higher efficiency, thereby reducing the maintenance difficulty and maintenance cost of the risk control system.

In the embodiment, the model for identifying transactions susceptible to interference may be generated based on machine learning of positive and negative samples (which may include various types of machine learning such as decision tree-based machine learning or in-depth learning based on neural networks, etc., which is not limited here). The positive samples include interfered transactions, and the negative samples include transactions not interfered that do not actually have pose a risk. In the embodiment, a model for identifying transactions susceptible to interference is generated through the adoption of the manner of machine learning, which may achieve the automatic creation and update of the model for identifying transactions susceptible to interference, exempt or greatly reduce the maintenance costs of the operator for the model for identifying transactions susceptible to interference, and improve the maintenance efficiency of the model for identifying transactions susceptible to interference. Learning from transactions that have already occurred and been interfered makes the model for identifying transactions susceptible to interference fully grasp characteristics of transactions susceptible to interference, thereby enabling accurate identification of transactions susceptible to interference without creating identification rules pertaining to interference.

In one embodiment, when the model for identifying transactions susceptible to interference is in an initialization state, the above-described positive samples are obtained by weighted sampling of all transactions within a specified historical time period. For example, the weighted value of a weighted sample is negatively related to an interval between the sampling time and the time of occurrence of the collected transaction sample, which causes the model for identifying transactions susceptible to interference to comprehensively learn the transactions susceptible to interference while ensuring the model for identifying transactions susceptible

to interference is able to adapt to the development and changes of transactions susceptible to interference. For example, the weighting of the positive samples may conform to the following formula: $w_i = e^{-\eta \alpha_i}$, where w_i is the weight corresponding to the i^{th} positive sample, η is a predefined adjustable parameter, and α_i is the time interval corresponding to the i^{th} positive sample. Since the probability of change and degree of change of the negative samples are usually low, the negative samples may be obtained by evenly sampling all the transactions within the specified historical time period.

In another embodiment, when the model for identifying transactions susceptible to interference is a newer model obtained by updating an older model, the positive samples may include at least one of the following: transactions susceptible to interference not identified in the older version model, transactions susceptible to interference identified in the older version model. Here, transactions susceptible to interference not identified in the older version model adapt to the development and changes of transactions susceptible to interference to make the model for identifying transactions susceptible to interference able to learn the latest transactions susceptible to interference; while the transactions susceptible to interference identified in the older version mode inherit the characteristics of the transactions susceptible to interference learnt by the older version model. Here, the negative samples may be obtained by evenly sampling all the transactions within the time period of the positive samples.

In the embodiment, the version of model for identifying transactions susceptible to interference may be updated according to a preset period. Since the model for identifying transactions susceptible to interference is obtained through machine learning, the version update process can be automated for high efficiency and minimal maintenance costs.

In step 404, a processing manner for the transaction to be processed is determined based on the first identification result and the second identification result, the processing manner including releasing the transaction to be processed, or further identifying risks pertaining to the transaction to be processed via the in-depth identification layer in the risk control system.

In the embodiment, values of a decision function $f(R, D)$ can be calculated according to the following formula: $f(R, D) = R \cdot I(\beta > R > \alpha) \cdot e^{-D} + I(R \geq \beta)$, where R is a risk score included in the first identification result, D is an interference tendency score included in the second identification result, α and β are preset parameter values and $0 < (\alpha, \beta) < 1$, the value of $I(x)$ is 1 when condition x is satisfied, or is 0 when condition x is not satisfied; when $f(R, D) < \theta$, the processing manner is to release the transaction to be processed; when $\theta < f(R, D) < 1$, the in-depth identification layer of the risk control system further performs risk identification on the transaction to be processed; here, θ is a preset threshold and $0 < \theta < 1$.

For ease of understanding, take the following network platform payment scenario as an example, the technical solution of the present application for the risk control system is applied to the process of identifying the risk of account theft of the payment transaction, and the technical solution of the present application is described in detail in combination with FIG. 5.

FIG. 5 is a schematic diagram of a risk control system 500 according to an exemplary embodiment. As shown in FIG. 5, the risk control system 500 includes a fast identification layer 502 (namely layer T1) and an in-depth identification layer 504 (namely layer T2). For example, layer T2 may be

the same as layer T2 in FIG. 2 and will not be elaborated here. In the embodiment, layer T1 is improved. As shown in FIG. 5, in the risk control system 500, in addition to the fast identification rules of the relevant technology, layer T1 is also configured with an identification model 506 pertaining to payment transactions susceptible to interference, and an integrated decision-making module 508.

In an embodiment, the risk control system 500 involves an initialization (that is, creation) operation of the identification model 506 pertaining to payment transactions susceptible to interference. The initialization operation can be achieved in the following manner.

Firstly, the risk control system 500 can acquire training samples, which include positive and negative samples, for initialization of the model. For example, a positive sample may be an interfered payment transaction that has occurred, namely, a payment transaction that is identified as having the risk of account theft by the risk control system, but is later verified as not having this risk; and a negative sample may be a payment transaction that is not identified as having the risk of account theft by the risk control system, and is later verified as not having this risk.

The training samples may be obtained from a specified historical time period, such as payment transactions that occurred in the most recent week. Here, since payment transactions susceptible to interference that count as positive samples account for a relatively small proportion of the total number of payment transactions, this is prone to violent fluctuations and changes, thus the required positive samples may be obtained from weighted sampling of all payment transactions. Moreover, the weight value of a weighted sample may be negatively related to the interval between the sampling time and the time of occurrence of the collected transaction sample, causing the positive samples closer to the time of sampling to have a greater influence on the training process, thereby allowing the identification model pertaining to payment transactions susceptible to interference obtained from training to adapt to changes in payment transactions susceptible to interference, to improve the accuracy of identification of payment transactions susceptible to interference.

For example, the weighting of the positive samples may conform to the following formula:

$$w_i = e^{-\eta \alpha_i}$$

where w_i is the weight corresponding to the i^{th} positive sample, η is a predefined adjustable parameter, and α_i is the time interval corresponding to the i^{th} positive sample.

For negative samples, since the changes of negative samples are usually smaller, the value can be obtained by uniform sampling.

Then, the training samples obtained can be used to train the initialized identification model pertaining to payment transactions susceptible to interference. In the training process, any of the two-class classification algorithms in the related technology can be used for training. The present application has no limitation on this.

Based on the identification model 506 pertaining to payment transactions susceptible to interference obtained via training, identification can be performed on a payment transaction to be processed in the risk control system 500 to obtain an interference tendency score D for the payment transaction to be processed. At the same time, the payment risk score R for the payment transaction to be processed can be obtained according to the fast identification rules of layer T1, and as shown in FIG. 5, the integrated decision-making module 508 can be used to combine the payment risk score

R and the interference tendency score D to determine the processing manner of the payment transaction to be processed.

For example, a decision function $f(R, D)$ may be created, and $f(R, D)$ may be defined as:

$$f(R, D) = R \cdot I(\beta > R > \alpha) \cdot e^{-D} + I(R \geq \beta)$$

where, α , β are preset parameter values and $0 < (\alpha, \beta) < 1$, and the value of $I(x)$ is 1 when condition x is met and 0 when condition x is not met.

Accordingly, by setting a threshold value θ ($0 < \theta < 1$), the processing manner be determined according to the relationship between the decision function $f(R, D)$ and the threshold θ , e.g.:

1). when $f(R, D) < \theta$, the processing manner is releasing the payment transaction to be processed (510). Wherein, there may be two scenarios:

Scenario 1: the security level of the payment transaction to be processed is very high so that the payment risk score R meets $R < \alpha$, $f(R, D) = 0$, indicating that the payment transaction to be processed has been determined as secured and can be released directly.

Scenario 2: the payment risk score R meets $\beta > R > \alpha$, indicating that the payment transaction to be processed is subject to payment risks; however, as the payment transaction to be processed is highly likely to be subject to interference, it can thus be determined as a whole that the payment transaction to be processed is susceptible to interference and is released accordingly.

2). When $\theta < f(R, D) \leq 1$, it means that the payment transaction to be processed is subject to certain payment risks and the likelihood of the payment transaction to be processed being subject to interference is low, it can thus be determined that the payment transaction to be processed is not a payment transaction susceptible to interference. The risk pertaining to the payment transaction to be processed is further identified by the T2 layer in the risk control system 500 for processing (512).

As described above, in view that the payment transactions susceptible to interference are subject to changes easily, the model for identifying payment transactions susceptible to interference is continuously updated so that it can accurately identify payment transactions susceptible to interference that have changed.

In the technical solution of this application, the model 506 for identifying payment transactions susceptible to interference may be updated periodically, e.g. updated on a daily or weekly basis, and the frequency may be set according to actual circumstances. The update process is similar to the above described initialization process, with the only difference lying in the training samples used.

For positive samples, there can be two sources. Source 1: the interfered payment transactions identified by the old version model (i.e. the to-be-updated model for identifying payment transactions). As the interfered payment transactions are identified by the old version model, it can be ensured that the new version model will be able to inherit the training results of the old version model, enabling the new version model to identify identical or similar payment transactions susceptible to interference. Source 2: the interfered transactions that occur within the time frame of the positive samples (e.g., the latest 2 days or other time frame), so that the new version model is able to adapt to the update of the payment transactions susceptible to interference; wherein, when the time frame of the positive samples is relatively short, all interfered payment transactions in the time frame of the positive sample can be used; when the time

frame of the positive samples is relatively long, the interfered payment transactions in the time frame of the positive samples can be sampled. With respect to the above, references may be made to the above described initialization process.

With respect to negative samples, they may be obtained by evenly sampling the transactions within the time period of the positive samples.

Based on the training samples, the binary classification algorithm may be used for the sample training to obtain the new version model so as to update the model for identifying payment transactions susceptible to interference.

It can be seen from the above technical solution that transactions susceptible to interference may be identified via a fast identification layer and an identification model for transactions susceptible to interference before the in-depth identification of the risk control system, thereby identifying transactions susceptible to interference quickly and accurately in the scenario where risks are controllable, and reducing the probability of interfering transactions susceptible to interference, as well as reducing the impact on the risk control system and lowering the improvement requirements needed for the risk control system.

FIG. 6 is a schematic diagram of an electronic device 600 according to an exemplary embodiment. Referring to FIG. 6, the electronic device 600 includes a processor 602, an internal bus 604, a network interface 606, and a memory such as an internal memory 608 and a nonvolatile memory 610. The electronic device 600 may further include other hardware needed for transactions. The processor 602 reads a corresponding computer program from the nonvolatile memory (NVM) 610 to the internal memory 608 and runs the computer program to form a risk identification apparatus for transactions to be processed at a logical level.

FIG. 7 is a schematic diagram of a risk identification apparatus 700 for transactions to be processed, according to an exemplary embodiment. Referring to FIG. 7, the risk identification apparatus 700 for transactions to be processed may include: a first identification unit 71, which identifies risks pertaining to a transaction to be processed via a fast identification layer in a risk control system, thereby obtaining a first identification result; a second identification unit 72, which identifies the risks of interference pertaining to the transaction to be processed via a model for identifying transactions susceptible to interference, thereby obtaining a second identification result; and a determination unit 73, which determines a processing manner for the transaction to be processed based on the first identification result and the second identification result, the processing manner including releasing the transaction to be processed, or further identifying risks pertaining to the transaction to be processed via an in-depth identification layer in the risk control system.

In an embodiment, the model for identifying transactions susceptible to interference is generated by way of machine learning based on positive samples and negative samples, the positive samples including: interfered transactions, and the negative samples including transactions that are not interfered and have no risks.

In an embodiment, when the model for identifying transactions susceptible to interference is in an initial state, the positive samples are obtained by weighted sampling of all transactions in a specified historical period, wherein the weight of weighted sampling is negatively correlated to the interval between the sampling time and the time of the sampled transaction.

In an embodiment, the weight of the positive samples conforms to the following formula:

$$w_i = e^{-\eta \alpha_i}$$

where w_i is the weight of the i^{th} positive sample, η is a predefined adjustable parameter, α_i is the interval of the i^{th} positive sample.

In an embodiment, the negative samples are obtained by evenly sampling in all transactions within a specified historical period.

In an embodiment, when the model for identifying transactions susceptible to interference is a new version model obtained by updating an old version model, the positive samples may include at least one of the following: transactions susceptible to interference not identified by the old version model, transactions susceptible to interference identified by the old version model.

In an embodiment, the negative samples are obtained by uniformly sampling all the transactions within the time period of the positive samples.

In an embodiment, the version of the model for identifying transactions susceptible to interference is updated according to a preset period.

In an embodiment, the determination unit 73 is used for: calculating a value of a decision function $f(R, D)$ according to the following formula: $f(R, D) = R \cdot I(\beta > R > \alpha) \cdot e^{-D} + I(R \geq \beta)$; where R is a risk score included in the first identification result, D is an interference tendency score included in the second identification result, α and β are preset values and $0 < (\alpha, \beta) < 1$, the value of $I(x)$ is 1 when condition x is met and 0 when condition x is not met.

Where $f(R, D) < \theta$, the processing manner is releasing the transaction to be processed; where $\theta < f(R, D) \leq 1$, the in-depth identification layer in the risk control system further identifies risks in the transaction to be processed, wherein θ is a preset threshold value, and $0 < \theta < 1$.

The electronic devices, apparatuses, modules or units illustrated in the above-described embodiments may be achieved by computer chips or entities, or by products with certain functions, such as a computer. Examples of the electronic devices and apparatuses include a personal computer, laptop computer, cell phone, camera phone, smart phone, PDA (personal digital assistant), media player, navigation device, email sending and receiving device, game console, tablet computer, wearable device or any combination of these devices.

Each of the above described models, modules, and units may be implemented as software, or hardware, or a combination of software and hardware. For example, each of the above described models, modules, and units may be implemented using a processor executing instructions stored in a memory. Also, for example, each of the above described models, modules, and units may be implemented with one or more application specific integrated circuits (ASICs), digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), controllers, micro-controllers, microprocessors, or other electronic components, for performing the above described methods.

In a typical configuration, the computer includes one or more processors (CPUs), I/O interfaces, network interfaces and internal memories.

The internal memories may be computer readable media in the form of volatile memory, random access memory (RAM) and/or non-volatile memory such as read-only memory (ROM) or flash memory (flash RAM). Internal memory is an example of the computer readable media.

Computer readable media include non-volatile and volatile and movable and non-movable media, and information

storage may be achieved by any method or technology. Information may be computer readable instructions, data structures, program modules or other data. Examples of computer storage media include but are not limited to phase change random access memory (PRAM), static random access memory (SRAM), dynamic random access memory (DRAM) and other types of random access memory (RAM), read only memory (ROM), electrically erasable programmable read only memory (EEPROM), flash memory other memory technologies, compact disc-read only memory (CD-ROM), digital versatile disc (DVD) or other optical memory, cassette type magnetic tape, magnetic disk memory, magnetic tape, magnetic disc storage or other magnetic storage devices or any other non-transmission media. They may be used to store information that is accessible to computer devices. The computer readable media here do not include transitory media, such as modulated data signals and carriers.

It should be further noted that terms “include,” “comprise” or any variants of these terms are intended to cover non-exclusive inclusion so that a process, method, article or equipment including a series of elements not only includes these elements but also includes other elements that are not expressly listed, or also includes the elements inherent to such process, method, article or equipment. In the absence of more limitations, the element defined by a sentence “include a . . .” does not exclude that the process, method, article or equipment including the element also have another identical element.

Here, exemplary embodiments are described in detail, with examples shown in the accompanying drawings. When the description involves the accompanying drawings, unless otherwise indicated, the same numeral in different accompanying drawings stands for the same or similar element. The implementation manners described in the exemplary embodiments do not represent all the implementation manners consistent with the present application. To the contrary, they are merely examples of the apparatus and method described in detail in the attached claims and are consistent with some aspects of the present application.

The terms used in the description are merely for the purpose of describing certain embodiments, instead of limiting the specification. The singular forms “a,” “the” and “this” used in the description and in the attached claims also are intended to cover plural forms unless their meanings are otherwise clearly indicated in the context. It should also be understood that the term “and/or” used in the text refers to any or all possible combinations containing one or more of the associated listed items.

It should be understood that although the specification may use terms such as first, second and third to describe various kinds of information, the information should not be limited to these terms. These terms are only intended to differentiate information of the same type. For example, without departing from the scope of the specification, first information may also be referred to as second information, and similarly, second information may also be referred to as first information. Subject to the context, the term “if” used here may be interpreted as “at the time of . . . ,” “when . . . ,” or “in response to a determination.”

The above embodiments are merely exemplary embodiments but not intended to limit the specification, and various modifications and changes can be made thereto without departing from the scope of the specification. The scope of the specification is only restricted by the appended claims.

The invention claimed is:

1. A method for identifying a risk pertaining to a transaction to be processed on an online platform, comprising:
 - generating, in a fast identification layer in a risk control system, a model for identifying transactions susceptible to false-positive interference, wherein the model is generated by machine learning based on positive samples and negative samples, the machine learning including at least one of decision tree-based machine learning or in-depth learning based on neural networks, the positive samples including interfered transactions for training the model for identifying transactions susceptible to false-positive interference, the negative samples including non-interfered transactions that are subject to no risks for training the model for identifying transactions susceptible to false-positive interference;
 - identifying a risk pertaining to the transaction on the online platform via the fast identification layer in the risk control system, thereby obtaining a first identification result;
 - identifying a risk of false-positive interference pertaining to the transaction on the online platform via the model for identifying transactions susceptible to false-positive interference, thereby obtaining a second identification result; and
 - determining a processing manner for the transaction on the online platform, based on the first identification result and the second identification result, wherein the risk control system is implemented by a server, and the generating the model for identifying transactions susceptible to false-positive interference, the identifying the risk pertaining to the transaction on the online platform, the identifying the risk of false-positive interference pertaining to the transaction on the online platform, and the determining the processing manner for the transaction on the online platform are performed by a processor of the server; and wherein determining the processing manner of the transaction on the online platform comprises:
 - calculating a score of a decision function based on a risk score included in the first identification result and an interference tendency score included in the second identification result;
 - when the score of the decision function is smaller than a preset threshold value, releasing the transaction on the online platform; and
 - when the score of the decision function is greater than the preset threshold value, further identifying, by an in-depth identification layer in the risk control system, the risk pertaining to the transaction on the online platform, wherein a number of fast identification rules in the fast identification layer in the risk control system is smaller than a number of in-depth identification rules in the in-depth identification layer in the risk control system.
2. The method according to claim 1, wherein the score of the decision function is calculated according to $f(R, D) = R \cdot I(\beta > R > \alpha) \cdot e^{-D} + I(R \geq \beta)$, where $f(R, D)$ is the score of the decision function, R is the risk score included in the first identification result, D is the interference tendency score included in the second identification result, α and β are preset values and $0 < (\alpha, \beta) < 1$, e is a base of a natural exponential function, and a value of $I(x)$ is 1 when condition x is met and 0 when condition x is not met.
3. The method according to claim 2, wherein when the model for identifying transactions susceptible to false-positive interference is in an initial state, the positive samples are obtained by weighted sampling all transactions in a specified historical period, wherein a weight of weighted sampling is

13

negatively correlated to an interval between a sampling time and a time of a sampled transaction.

4. The method according to claim 3, wherein the weight of positive samples complies with formula $w_i = e^{-\eta \alpha_i}$, where w_i is the weight of an i^{th} positive sample, η is a predefined adjustable parameter, and α_i is an interval of the i^{th} positive sample.

5. The method according to claim 3, wherein the negative samples are obtained by sampling in all transactions in the specified historical period.

6. The method according to claim 2, wherein when the model for identifying transactions susceptible to false-positive interference is a newer version model obtained by updating an older version model, the positive samples comprise at least one of interfered transactions not identified in the older version model, or interfered transactions identified in the older version model.

7. The method according to claim 6, wherein the negative samples are obtained by sampling in all transactions in a period in which the positive samples are obtained.

8. The method according to claim 2, wherein a version of the model for identifying transactions susceptible to false-positive interference is updated according to a preset period.

9. An electronic device operating as a server, comprising: a processor; and a memory storing instructions executable by the processor;

wherein the processor is configured to:

generate, in a fast identification layer in a risk control system, a model for identifying transactions susceptible to false-positive interference, wherein the model is generated by machine learning based on positive samples and negative samples, the machine learning including at least one of decision tree-based machine learning or in-depth learning based on neural networks, the positive samples including interfered transactions for training the model for identifying transactions susceptible to false-positive interference, the negative samples including non-interfered transactions that are subject to no risks for training the model for identifying transactions susceptible to false-positive interference; identify a risk pertaining to a transaction on an online platform via the fast identification layer in the risk control system, thereby obtaining a first identification result;

identify a risk of false-positive interference pertaining to the transaction on the online platform via the model for identifying transactions susceptible to false-positive interference, thereby obtaining a second identification result; and

determine a processing manner for the transaction on the online platform, based on the first identification result and the second identification result,

wherein the risk control system is implemented by the server; and

wherein determining the processing manner of the transaction on the online platform comprises:

calculating a score of a decision function based on a risk score included in the first identification result and an interference tendency score included in the second identification result;

when the score of the decision function is smaller than a preset threshold value, releasing the transaction on the online platform; and

when the score of the decision function is greater than the preset threshold value, further identifying, by an in-depth identification layer in the risk control system, the

14

risk pertaining to the transaction on the online platform, wherein a number of fast identification rules in the fast identification layer in the risk control system is smaller than a number of in-depth identification rules in the in-depth identification layer in the risk control system.

10. The electronic device according to claim 9, wherein the score of the decision function is calculated according to $f(R, D) = R \cdot I(\beta > R > \alpha) \cdot e^{-D} + I(R \geq \beta)$, where $f(R, D)$ is the score of the decision function, R is the risk score included in the first identification result, D is the interference tendency score included in the second identification result, α and β are preset values and $0 < (\alpha, \beta) < 1$, e is a base of a natural exponential function, and a value of $I(x)$ is 1 when condition x is met and 0 when condition x is not met.

11. The electronic device according to claim 10, wherein when the model for identifying transactions susceptible to false-positive interference is in an initial state, the positive samples are obtained by weighted sampling all transactions in a specified historical period, wherein a weight of weighted sampling is negatively correlated to an interval between a sampling time and a time of a sampled transaction.

12. The electronic device according to claim 11, wherein the weight of positive samples complies with formula $w_i = e^{-\eta \alpha_i}$, where w_i is the weight of an i^{th} positive sample, η is a predefined adjustable parameter, and α_i is an interval of the i^{th} positive sample.

13. The electronic device according to claim 11, wherein the negative samples are obtained by sampling in all transactions within a specified historical period.

14. The electronic device according to claim 10, wherein when the model for identifying transactions susceptible to false-positive interference is a newer version model obtained by updating an older version model, the positive samples include at least one of: interfered transactions not identified in the older version model, interfered transactions identified in the older version model.

15. The electronic device according to claim 14, wherein the negative samples are obtained by sampling in all transactions within a period in which the positive samples are obtained.

16. The electronic device according to claim 10, wherein a version of the model for identifying transactions susceptible to false-positive interference is updated according to a preset period.

17. A non-transitory computer-readable storage medium having stored therein instructions that, when executed by a processor of a device operating as a server, cause the device to perform a method for identifying a risk pertaining to a transaction to be processed on an online platform, the method comprising:

generating, in a fast identification layer in a risk control system, a model for identifying transactions susceptible to false-positive interference, wherein the model is generated by machine learning based on positive samples and negative samples, the machine learning including at least one of decision tree-based machine learning or in-depth learning based on neural networks, the positive samples including interfered transactions for training the model for identifying transactions susceptible to false-positive interference, the negative samples including non-interfered transactions that are subject to no risks for training the model for identifying transactions susceptible to false-positive interference; identifying a risk pertaining to a transaction via the fast identification layer in the risk control system, thereby obtaining a first identification result;

identifying a risk of false-positive interference pertaining
to the transaction on the online platform via the model
for identifying transactions susceptible to false-positive
interference, thereby obtaining a second identification
result; and 5
determining a processing manner for the transaction on
the online platform, based on the first identification
result and the second identification result,
wherein the risk control system is implemented by the
server; and 10
wherein determining the processing manner of the trans-
action on the online platform comprises:
calculating a score of a decision function based on a risk
score included in the first identification result and an
interference tendency score included in the second 15
identification result;
when the score of the decision function is smaller than a
preset threshold value, releasing the transaction on the
online platform; and
when the score of the decision function is greater than the 20
preset threshold value, further identifying, by an in-
depth identification layer in the risk control system, the
risk pertaining to the transaction on the online platform,
wherein a number of fast identification rules in the fast
identification layer in the risk control system is smaller 25
than a number of in-depth identification rules in the
in-depth identification layer in the risk control system.

* * * * *